

United States Fire Administration

Urban Search and Rescue in the Crested Butte, Colorado, State Bank Following an Explosion/Collapse



**Federal Emergency Management Agency
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Office of Firefighter Health and Safety

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Urban Search and Rescue Program

As a result of a number of major emergencies including structural collapse both here and abroad over the last decade, the concept of search and rescue (USAR) has become increasingly recognized as an important element in integrated emergency response. These incidents include catastrophic earthquakes in California, the Philippines and Soviet Armenia and structural collapses in Brownsville, Texas, and New York City. Following Hurricane Hugo and the California earthquake in 1989, both of which served to draw attention to the need for improve urban search and rescue capabilities and and resources, the Federal Emergency Management Agency (FEMA) undertook a major initiative to establish a National Urban Search and Rescue

The initial goal of the FEMA program has been to establish 25 qualified USAR task forces placed strategically throughout the nation. These task forces provide the ability to respond to major incidents within a few hours of activation and offer a fug range of capabilities in incident management; search; rescue: specialty medical care for entrapped patients; and technical disciplines including structural engineering, heavy equipment operation, hazardous materials and communications.

In addition, an Advisory Committee on the National USAR System has been formed consisting of federal government experts, state and local officials, and the private sector to guide further development of the System and to serve as a forum for discussing issues and exchanging information related to urban search and rescue.

To complement the efforts of the Federal Emergency Management Agency in Urban Search and Rescue, the United States Fire Administration (USFA) has also initiated research and development and information dissemination efforts on USAR Study reports are being produced for USFA under its "Investigation of Urban Search and Rescue Incidents" program that will broaden the base of information available about USAR tactics, management and technology, and contribute to reducing the number and severity of casualties by highlighting the lessons learned, both the successes and the failures, from such operations in the past The investigation reports, such as this one, provide detailed information about the magnitude and nature of the incidents themselves; how the response to the incidents was carried out and managed; and the impact of these incidents on emergency responders and the emergency response systems in the community. The United States Fire Administration greatly appreciates the cooperation and information it is receiving from the fire service, county and state officials, and other emergency responders as this research progresses

Additional copies of this report can be ordered from the Federal Emergency Management Agency/United States Fire Administration. For more information about USFA's program, write United States Fire Administration, 16825 South Seton Avenue, Emmitsburg, Maryland 21727.

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**Urban Search and Rescue in
the Crested Butte, Colorado, State Bank
Following an Explosion/Collapse
March 6, 1990**

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OVERVIEW

On Tuesday, March 6, 1990, at approximately 8:55 a.m., there was an explosion and subsequent collapse of the Crested Butte State Bank (CBSB), 405 Sixth Street, Crested Butte, Colorado, which killed three bank employees and injured fourteen other people. The magnitude of the explosion leveled most of the two-story brick structure, trapping some of the victims in void spaces throughout the rubble. The force of the blast blew the doors from the bank vault and embedded a metal window frame from the bank into the wall of a wooden building 40 to 50 feet away. A heavy winter snow storm complicated rescue operations and medical transportation of the injured.

ACKNOWLEDGEMENTS

The Federal Emergency Management Agency, United States Fire Administration gratefully acknowledges the cooperation of the members of the

Crested Butte Fire District, Chief (ret.) Jerry Chiles, Chief Jeff Neumann, Assistant Chief Mike Hellend, District Manager Mike Miller, and EMS Coordinator Noel Adam. Each was generous with his time, expertise, and counsel.

The staff of Fire Chief and its Managing Editor, Karen Wojcik-Berner, deserve acknowledgement and thanks for their permission to excerpt portions of an article by Dave Siengo and Jeff Neumann, ‘Explosion Rocks Small Town,’ published in the November 1990 issue.

THE BUILDING

The CBSB was a 2-story building, 30 feet by 50 feet, of brick joist construction. The floors were supported by joists with wood decking, and the flat roof was joist with wood decking and a membrane roof. All buildings in Crested Butte are required to withstand a snow load of 200 pounds per square foot. (See Appendix A for area map and building diagrams.)

The foundation was spread footing and stem wall constructed, the foundation walls of the building were concrete, and the footings were about eight feet below grade. The footings were covered with approximately three feet of earth, leaving a five foot crawl space with an earth floor below the first floor of the bank. The bank did not have propane gas service. Electric utilities ran in the ceiling of the crawl space, below the first floor.

CRESTED BUTTE FIRE PROTECTION DISTRICT

The Crested Butte Fire Protection District is a combination department of four paid staff and 32 volunteer firefighters, who staff three engines, one ladder,

and one equipment van. The community is also served by an EMS combination department of one paid staff and 20 volunteers, who staff two Type II ambulances.

THE EXPLOSION

At 8:58 a.m., the first of several calls was received by Gunnison Dispatch (the 911 communications center for the area) reporting that the Crested Butte State Bank had just exploded and collapsed. While the bank had not yet officially opened that Tuesday morning, there were some customers in the building. Since the town is so small, emergency personnel were on the scene right away. Assistant Chief (AC) Mike Hellend's description of his arrival is riveting.

"When I arrived, I couldn't believe what I was seeing. This is a small town, you know everyone. It's our only bank. I knew everyone who works there, everyone. Everyone in the town banks there, it's the only place you can go. The tourists from the ski resorts are always there getting cash. The building was flattened, the roof on top of everything. All four outside walls were a pile of rubble no further than eight feet from where they once stood. Part of the back wall was still standing because it had been protected by the vault on the first floor, and I ran around the back. I saw the president of the bank, my friend. He was out the window, suspended upside down from the knees like a trapeze artist, precariously hung from the window flat against the wall. Blood from his head was streaming down the wall and he was moaning for help. Apparently his foot got stuck under his desk and his knee was the cantilever that held him in the window."

"We got a ladder up to get him down, but how many others were trapped? What happened here? How many more of my friends are in this rubble?"

Chief Jeff Neumann, Chief Jerry Chiles, and AC Hellend had the presence of mind to write down their initial and continuing observations of the rescue effort. Chief Neumann's notes: "The first page (call) came in at approximately 9:05 am.; the ambulance was needed at the CBSB. The second page called for the fire department. Upon arrival, there were no flames or smoke showing. There was no smell of unusual odors when we arrived. The weather was about 30⁰F, light snow and cloudy. The Crested Butte State Bank had been leveled, and there were people trapped. I set up the command post assisted by Chief Chiles, and AC Hellend was assigned exterior operations. R. Ely was assigned Safety Officer. All utilities were ordered shut down, and we discovered that there was no gas service to the building. Mike Miller was assigned Information Officer. Patty and Noel Adam were assigned overall EMS operations. I directed that a handline (hoseline) be stretched."

"The Police, through Chief Largo, summoned the heavy equipment that we needed, (a backhoe and a payloador from the city, another backhoe was offered by a local contractor), and taped the perimeter to keep the crowds back. Chief Largo thought that we should get an investigation by the Bureau of Alcohol, Tobacco, and Firearms because he suspected an explosive device. He summoned them. Officer David York from Mount Crested Butte (an adjacent community) compiled a list of known people who were occupying the bank at the time of the explosion. We checked their names off as they were brought through triage."

"Flight for Life was mobilized, along with ambulances from Gunnison (30 miles away via two lane road), and all EMTs (40) were called in from this end of the valley. All of the above orders were given within five to seven minutes of the first call."

AC Hellend's notes: "All brick walls blown outward evenly in four directions. No smoke on arrival, no fire. Smelled like typical demolition dusts,

i.e., drywall dust., mortar/brick dust, wet lumber. Began rescue and dismantling of building debris at west and south sides of building. I did not observe any charring of building material until we reached the crawlspace. Four victims were rescued from the west side, first floor below grade. They showed signs of burns: hair singed, first and second degree burns on exposed skin, their clothes were not burned.”

“Observed that most, if not all, fiberglass batt insulation, which was installed between first floor joists, showed a slightly charred face, uniform throughout the crawlspace. The exposed parts of floor joists showed a darker discoloration, not quite charred. Inspected floor of crawlspace (earth) with Gas-Trac Detector. Did not find significantly elevated levels of concentrated gas at ground level or in pockets of debris.”

ORIGIN AND CAUSE

Crested Butte is one of a few communities (other than trailer parks) which receives underground propane gas service. However, the bank building did not have propane gas service. Coincidentally, the town had received its first and only bomb threat ever (two in two different places) two days before this incident, and original estimations of cause centered around a bomb device. Although some of the victims were seriously burned, there was no significant evidence of any structural fire. The level of damage and the lack of corroborating evidence quickly dismissed the bomb theory. Attention then turned to the possibility of leaking methane gas from an old mine or the generation of methane gas from the decay of organic material beneath the ground. Continuous gas surveys with detection equipment during and after rescue operations detected very low levels of a hydrocarbon gas. The absence of any gas odor with the attendant low level readings supported the methane gas theory, but the amounts of gas detected were consistently below explosive limits.

On March 12, after repeated gas monitoring and low level indications of the presence of gas, laboratory results of air samples revealed that the gas was propane, not methane. Once identified as propane, gas monitoring detected ground saturation and explosive levels in the basements of two other buildings near the bank. One of the buildings, the Bullion King Building, is a 2-story wooden commercial structure that was used to protect victims from the snow storm during the rescue operation. Had a second explosion occurred that day there would have been little left of that wooden structure.

Digging, pressurizing, and testing service pipes soon located a propane leak about 120 feet from the bank. The broken 1 1/2 inch propane pipe was the site of a previous leak which had been repaired three years before. The repair separated, and the leaking propane gas was scrubbed of its odorant, mercaptan, as it filtered through the earth. Heavier than air, the leaking odorless gas traveled much like water, away and down, seeking to equalize its level. Trapped between the bedrock below and a frost cap above, it crept along until it reached the earthen floor of the bank's 5-foot crawlspace. There it found its path of least resistance and entered the bank from below. An unknown source of ignition set off the gas.

THE COMMAND STRUCTURE

The Crested Butte Fire District (CBFD) trains in the Incident Command System every six months. This training is integrated with Emergency Medical Services and the Crested Butte Police Department (CBPD). An adjacent community, Mt. Crested Butte also participates in these training drills. When the bank explosion occurred, their training proved valuable.

One thing that had not been anticipated was the number of volunteers. At this incident, over 200 people began helping. Some were community residents and neighbors, others were vacationers. The number of volunteers quickly exceeded the number of trained rescuers, and it became clear to the IC that: 1) these people want to help, their help was needed; 2) they weren't trained; and 3) if they were told to hold back, controlling them could become a problem. One interesting note, the EMS sector was able to assemble a full medical trauma team made up of surgeons and other medical doctors who just happened to be vacationing in the resort area.

Chief Neumann sectored the incident and placed trained rescuers in charge of those sectors using untrained volunteers. Only trained personnel could enter the "footprint" of the building, volunteers had to work outside the building's foundation. Other volunteers were assigned to crowd control under the direction of the police or to the medical sector under the direction of the EMS coordinator. With all of these people involved, the identification of key personnel presented a problem. (This will be discussed further below in the section "Lessons Learned.")

THE OPERATION

Foremost in the IC's mind was the safety of the victims and the rescuers, and unanswered questions: "What caused this explosion? If it was a bomb, are there others waiting to explode and injure these rescuers? How could it have been a gas leak, the building doesn't have gas service? Is this a collapse from a snow load? Not likely, it's a brick building built to code (200 pounds per square foot capacity), and how do you account for the debris blown from the structure? What happened, and is there more to come?"

The IC requested through the police sector to have an officer track the victims: who they were, their injuries, and, if transported, by whom and to where.

This officer also interviewed the victims in an attempt to identify any other victims who might still be trapped in the rubble. Other officers, under the direction of the police sector, assisted in rescue operations, helped in the medical triage area, directed emergency equipment response and movements, provided security for bank records and currency, and controlled the crowd of onlookers.

Rescue operations inside and outside the footprint of the building commenced concurrently. Rescuers used a human chain “bucket brigade” to remove debris, diminishing the possibility of further injuries from falling or thrown debris. What debris could be removed by hand was, and any debris removal operation that required heavy equipment was assigned to a spotter. Each spotter was a trained officer, equipped with a radio, and in contact with the IC. The spotter made sure that all rescuers were out of the area, and the heavy equipment operator took all direction from the spotter. Once the heavy equipment completed its task, rescuers returned to the area. The use of heavy equipment in this snow resort community proved invaluable. Their experience with heavy snow removal means that operators had an unusually high level of proficiency, considering the size of the town.

Seven victims were removed from the structure alive: one from the second floor rear window, four trapped under a lean-to collapse in the rear of the building next to the vault, and two, who had been protected by office cabinets, from the front of the building. One victim was removed alive from rubble outside the building. Two of the deceased were found in rubble outside the building and one inside. The three people who died were women, ages 29,30, and 32. The remaining six victims were either blown clear of the building, dug out of the rubble early in the rescue operation, or were injured from flying debris while outside the building. There were 14 civilian casualties, who suffered first, second, and third degree burns, lacerations’ and trauma fractures.

The EMS sector coordinator set up a triage area away from the Command Post, near the road. One ambulance was stripped for supplies, and the other two were used for the treatment and transport of the injured. The stripped ambulance was later used to transport the deceased to a makeshift morgue in the fire station.

The amount of medical supplies on hand was quickly exhausted, and additional supplies were back at the station. With a critical need for trained personnel at the scene, and an abundance of willing volunteers, the coordinator wanted to send a volunteer back to the station for the needed supplies. Unfortunately, without a list of inventory items and their exact location, the coordinator had to send someone who knew the location and type of supplies needed. There were two lessons learned here, which will be described below.

Three mutual aid ambulances from Gunnison Valley Hospital (one Type II and two Type IIIs) were summoned, as were Flight for Life helicopters. An engine company from Gunnison also arrived on mutual aid. The previously described inclement weather conditions impeded mutual aid response. It took about 40 minutes for the ambulances to arrive from Gunnison through the snow, and about the same amount of time to return to Gunnison with the injured. Despite the fact that heavy equipment operators had cleared a landing zone, the “Flight for Life” helicopters were unable to land in Crested Butte, so they met the ambulances at Gunnison. All victims were transported 30 miles to Gunnison by ambulance, then they flew the injured to Grand Junction (45 minutes away) where there is a Level 3 Trauma Center and to Denver (one hour).

Within the first half hour, independent of each other, both the IC and the EMS coordinator realized that they would soon need the services of a Critical Incident Stress Debriefing (CISD) team. Two teams were summoned, the Mayflower Team from Denver and a CISD team from Durango, Colorado. Debriefing sessions were held the next day.

All of the known victims were removed within one and one-half hours, but there were continuing reports of an additional victim. Someone “heard” or “saw” a stranger in the bank before the explosion. No one could give a name or a description of this person, but the IC had to continue the search. This victim became known as the “phantom.” The search for the phantom required the removal of all the debris from the foundation of the structure, both by hand and heavy equipment. By 4:30 that afternoon, the entire structure, brick by brick, had been searched. No additional victims were found.

The IC and his commanders had the presence of mind to realize the importance of the bank itself. Although compared to life safety the bank was a secondary concern, it was the financial lifeblood of the community. Its records were important. People had made deposits and withdrawals. As a result of the explosion, there was currency blown all over the structure. During the search, every effort was made to protect bank records. Tarps protected the debris after it had been searched and removed. Currency was collected and secured. Although the official accounting is held confidential, it was reported that almost all of the currency was accounted for. Some of the currency was found burned, and it is believed that which was not recovered was probably burned in the explosion.

The reader should keep in mind that at the end of an eight hour rescue operation, after the entire building was searched brick by brick, and after continual gas monitoring, no cause for this explosion could be found. There was no bomb, no gas leak, no barbecue or welder’s tank found in the bank.

SUBSEQUENT OPERATIONS

In an interview, AC Hellend stated, “Compared to what followed, handling the rescue operation was the easy part.” The problems centered on two issues:

discovering and then responding to the cause of the explosion, and responding to outside agencies.

On March 12, six days later, it was confirmed that the cause of the explosion was propane gas, ignited from an unknown source. Once identified, gas detection samples revealed that there were explosive levels of propane gas in three adjacent buildings within a 200-foot radius of the bank. One, the Bullion King Building, had been used as a refuge for victims during the rescue effort! The earth in the surrounding area was saturated with propane. For days, sections of propane piping service lines in the surrounding area were excavated and pressurized in the search for the leak. Four days later, on the 16th, the source of the leak was discovered across the street, about 120 feet from the bank. Continued excavation and pressurization of the service lines revealed the presence of at least six more leaks throughout the town of Crested Butte.

For months after the explosion, residents of the town were very sensitive to the possibility of propane gas leaks. Despite assurances that the system had been checked, calls for reported gas leaks continued to tax the abilities of the CBFD.

The response of government agencies also burdened the CBFD. Since a bank was involved in the explosion, the Federal Bureau of Investigations responded. It was also an explosion, so the Bureau of Alcohol, Tobacco, and Firearms investigated. One of the original theories was that the gas may have been coal gas from an old mine, so the U.S. Mine Safety and Health responded. When the coal gas theory was discounted, and propane became suspect, the National Transportation Safety Board (interstate transport of gas) had to investigate as well as the Occupational Safety and Health Administration because propane is considered a hazardous material. The U.S. Geological Survey Team, the Colorado Geological Survey Team, the Colorado Department of Natural

Resources Division of Mines, and the Colorado Public Utilities Commission were among the other government agencies.

These groups were all poking and probing about while the members of the CBFD were working with the gas company to try and locate the leak. The CBFD's initial response to these agencies was cooperation, but after a while it became quite clear that while the federal government encourages, trains, and touts the Incident Command System, few from the federal government follow its tenets. Each agency felt that this was "their" investigation, ignoring the Incident Commander and issuing orders or requirements without his participation. In the beginning, the IC attempted to cooperate with each agency, but after about two weeks of this, he insisted that they follow proper protocol.

EPILOGUE

Most importantly, those victims who survived the initial explosion are still alive today. This is testimony to the talents, skills, and dedication of the Crested Butte Fire, EMS, and Police services, and the assistance rendered by surrounding communities and volunteers. A total of 32 fire personnel, 40 EMS personnel, six ski-team personnel, 200 civilians, four fire apparatus, five ambulances (three Advanced Life Support units, two Basic Life Support units), and five pieces of heavy equipment came together to accomplish this task.

Most readers of this report are probably asking "Why didn't they suspect propane right away? Why weren't they testing for propane?" The answer is simple. There was no reason to suspect propane. Propane has an "odor" from an odorant additive, mercaptan, but no one smelled anything anywhere near the bank even as rescue operations continued because the propane gas was being scrubbed of the odorant as it filtered through the soil. Moreover, while the town had propane gas service, it was known conclusively that the bank did not have propane

service. In light of the bomb threat two days earlier, the knowledge that the bank did not have gas service, and a complete absence of any detectable readings of gas in the rubble, there was no reason to suspect propane. Methane (from the abandoned mines) was more likely, but the readings that they were getting on the detection equipment was far below methane's explosive levels. The gas detector that was used indicated the presence of a hydrocarbon-based gas, and the percentage of gas/air mixture. Unless an operator has full knowledge of exactly what gas is being detected, it is impossible to determine from the meter which specific gas is being measured. In this case, the operator believed he was getting below explosive level readings of methane. In fact, he was getting above explosive level readings of propane. (See Appendix B for a propane/methane comparison chart.) These low levels of propane, which had been scrubbed of its odorant mercaptan, were indeed within propane's explosive limits. Once the lab results revealed that the gas being detected was propane, the buildings adjacent to the bank were evacuated, vented, and monitored.

LESSONS LEARNED: THE COMMAND STRUCTURE

1. ***Drills in the Incident command System (ICS) pay dividends.*** Crested Butte had interagency ICS drills every six months. When this disaster occurred, the command structure fell into place and everyone understood their roles and relationships.
2. ***Within the ICS, be prepared to utilize civilian volunteers.*** If the use of untrained volunteers becomes necessary, place a trained person in charge of their sector, and limit civilian volunteer efforts to low-risk areas. This worked effectively for the CBFD.
3. ***Leave the ICS structure in place for as long as is necessary.*** At large disasters, there are days or weeks of investigations, questions from news reporters,

government inquiries, and follow-up operations. Disassembling the ICS before these tasks are all completed can leave the IC in the position of being responsible, but not being in charge. There is no requirement that the system be disbanded as soon as the primary operation is completed. Keep the ICS in place in order to keep control.

4. *Appoint the ICS Information Officer as possible.* In large disasters, the media flock to the site. Rumor, innuendo, and supposition become newsworthy facts. Information accuracy and control become paramount when friends, neighbors, and relatives of victims are closely following the events.

5. *Have sufficient vests or other forms of identification for sector commanders.* Proper identification of sector commanders was a problem at the CBSB explosion. The CBFD has since purchased identifying vests for all sector commanders.

6. *In overlapping jurisdictional areas (state roads national parks, etc.) try to develop an interagency statement to identify authority, roles, relationships, and responsibilities before the need for them arises.* While this wasn't a problem in Crested Butte, upon reflection the IC and sector commanders realized that it could have been. They are developing those agreements now.

7. *Anticipate the possibilities of a second disaster.* Once again, this did not happen, but the IC and sector officers realized that it could. Planning should include where you are going to get additional help once your first and second sources of assistance have been exhausted.

8. *The telephone company can set up land-line telephone at the site any disaster operation in a relatively short time.* Although not a major point, it is good to know. Crested Butte is a mountainous region, reducing the operating range of

radio equipment. The telephone company offered to place a telephone line at the IC's disposal and were quickly taken up on the offer. The telephone line made long distance communication much easier, with little effort or cost.

9. Critical Incident Debriefing is as important for the IC and Sector

Commanders as it is for the rescuers. In some instances, commanders spent a lot of time making sure that their subordinates received CISD, but forgot about themselves. Without being specific, one or two mentioned that they wished that they had gotten into the CISD with their crews. Some followed up with CISD later on.

10. In a small town, the IC will wear many hats. Everyone looks to the IC for direction and early in the operation delegation may be a problem. The IC must delegate early. At this incident the IC delegated well, but once the incident was over (eight hours), all of the lead responsibilities reverted to him. Leaving the ICS in place and delegating to the sector officers even after the primary operation was completed would have eased the burden of the IC in the days and even weeks following this incident.

LESSONS LEARNED: THE OPERATION

11. When dealing with gas or suspected leak, keep in mind that your suspicions may mislead you. Detecting devices usually indicate the presence of a gas, not the specific type of gas. Also remember that just because the utility company odorizes gas with mercaptan, it doesn't mean that the absence of an odor is a reliable indicator of the absence of gas. In the CBSB explosion, gas detecting equipment indicated a low level of a hydrocarbon gas. Since there was no odor, or propane gas service lines in or near the bank, the operator

thought he was reading below explosive levels of methane gas. He was actually reading explosive levels of propane and didn't know it.

12. ***Victims of collapse can be trapped anywhere.*** In this instance, filing cabinets and the configuration of a lean-to collapse saved most of the survivors. Even if it looks like no one could survive, some may. Continue to operate as if there are live victims still trapped until everyone missing has been found. Consider the possibility that someone who has not yet been reported as missing (a shopper, a passerby) could also be trapped.

13. ***Appoint a Victim Tracking Officer.*** Make sure that you know who is missing or unaccounted for, who is receiving treatment, and who has been transported to a medical facility (by whom and to where). Police officers are especially suited to this task because of their ability to interview people under stress. Account for everyone.

14. ***When using heavy equipment to remove debris, assign a spotter to each piece of equipment to direct the equipment operator.*** The spotter should remain in radio contact with the IC. Keep all rescuers out of the area when heavy equipment is operating.

15. ***Communications were a problem at this operation because the department only had a one-channel radio.*** Operations of this size require at least a two-channel radio. The CBFD now has a two-channel system.

16. ***When directing operations, be continuously aware of safety.*** In the rush to assist, some people may ignore their own safety or that of others. Appoint a Safety Officer and make sure that this person continually monitors the rescue

operation. Consider the possibility that whatever caused the collapse could occur again during the rescue operation, injuring even more people.

17. ***Be aware that whatever caused the collapse may exist in surrounding buildings or outside areas.*** Keep onlookers further away than you probably think is necessary. Don't be so quick to occupy adjacent buildings Unless you are absolutely sure that the area is safe, presume that it is not. In the CBSB collapse, the ground and surrounding buildings were filled with propane gas, and the IC had no way of knowing it at the time.

18. ***Use the "bucket brigade" or human chain method of removing debris.*** This method eliminates the need for rescuers to walk over nails, broken wood, and glass. It also reduces rescuer fatigue and directs the placement of removed debris. However, at no time should citizen volunteers be placed in a position of danger. Local jurisdictions should consider developing standard operating procedures regarding the use, control, and safety of civilian volunteers.

19. ***At most businesses, especially banks, records are important.*** While secondary to life safety, the IC must consider the importance of these records and attempt to protect them by assigning someone to do that. At the CBSB explosion, the police sector handled this operation.

20. ***Consider the purchase of some sort of portable shelter to protect injured victims, especially in inclement weather.*** There are some portable shelters which inflate and provide a two or three room area. Although the CBFD didn't have this type of shelter, they are now considering the purchase of one.

21. ***Keep an accurate inventory of all equipment stored back in the station each apparatus.*** Be sure to list the amount and its location in the station. Identify

all equipment in inventory in a manner that anyone, even an untrained volunteer, can find and identify it without supervision or detailed instructions.

22. ***Develop a rescue clipboard and keep one in each vehicle.*** List any sources of equipment, an ICS outline, CISD information and team locations, local medical clinics, heavy equipment operators, or transportation resources.

23. ***As as is practical, write down your actions, the names of the sector commander, your initial orders, and activities.*** This can prove invaluable two or three years later when all the litigation begins. Write down or draw the site as you found it, the location of victims, placement of equipment, etc. Document as much of the operation as is possible as soon after the incident as is practical.

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Additional Readings

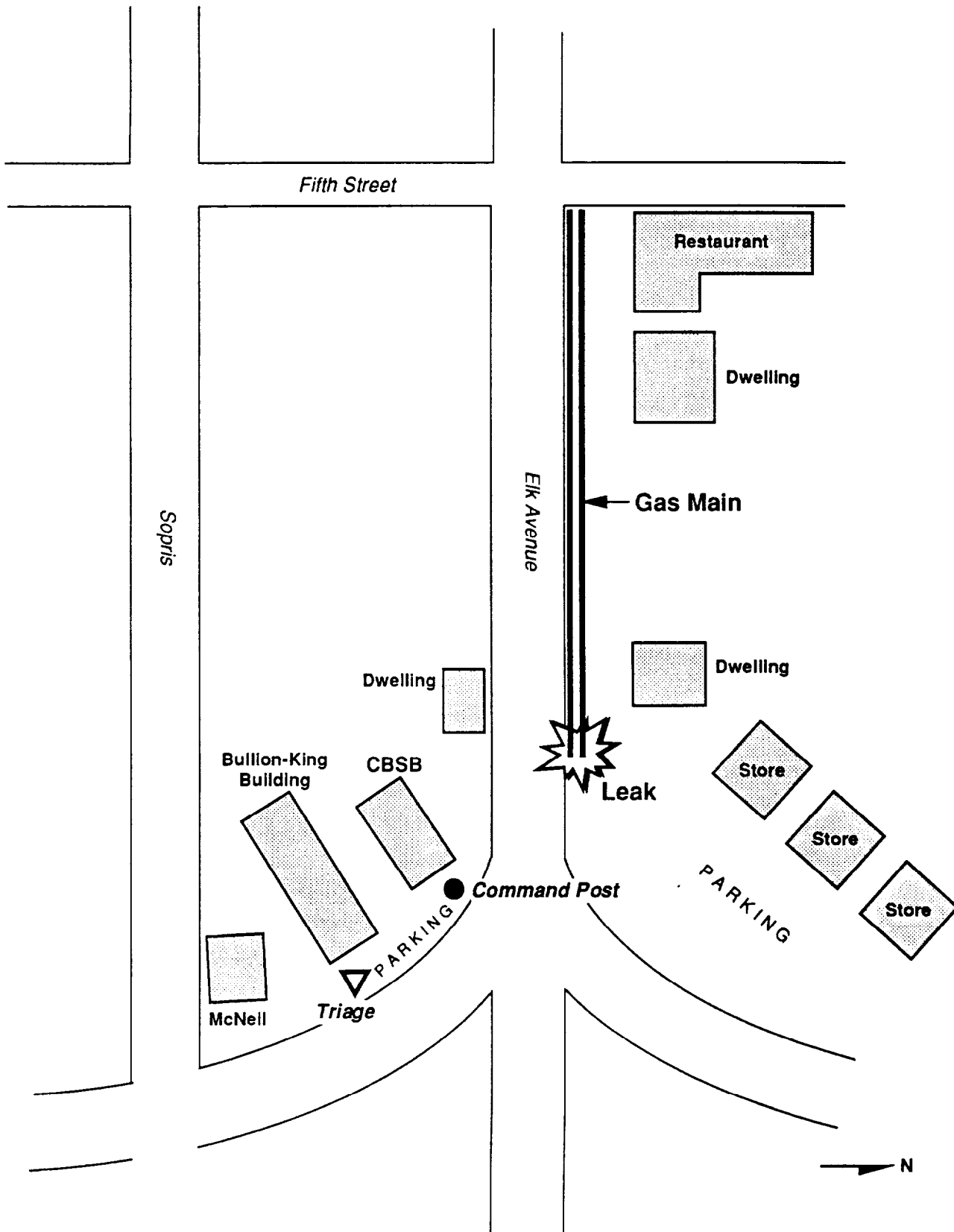
Sharp, Peg. "People Helping People." *Emergency*, August 1990.

Siengo, Dave, and Jeff Neumann. "Explosion Rocks Small Town." *Fire Chief*, November 1990.

Appendix A

Area Map and Building Diagrams

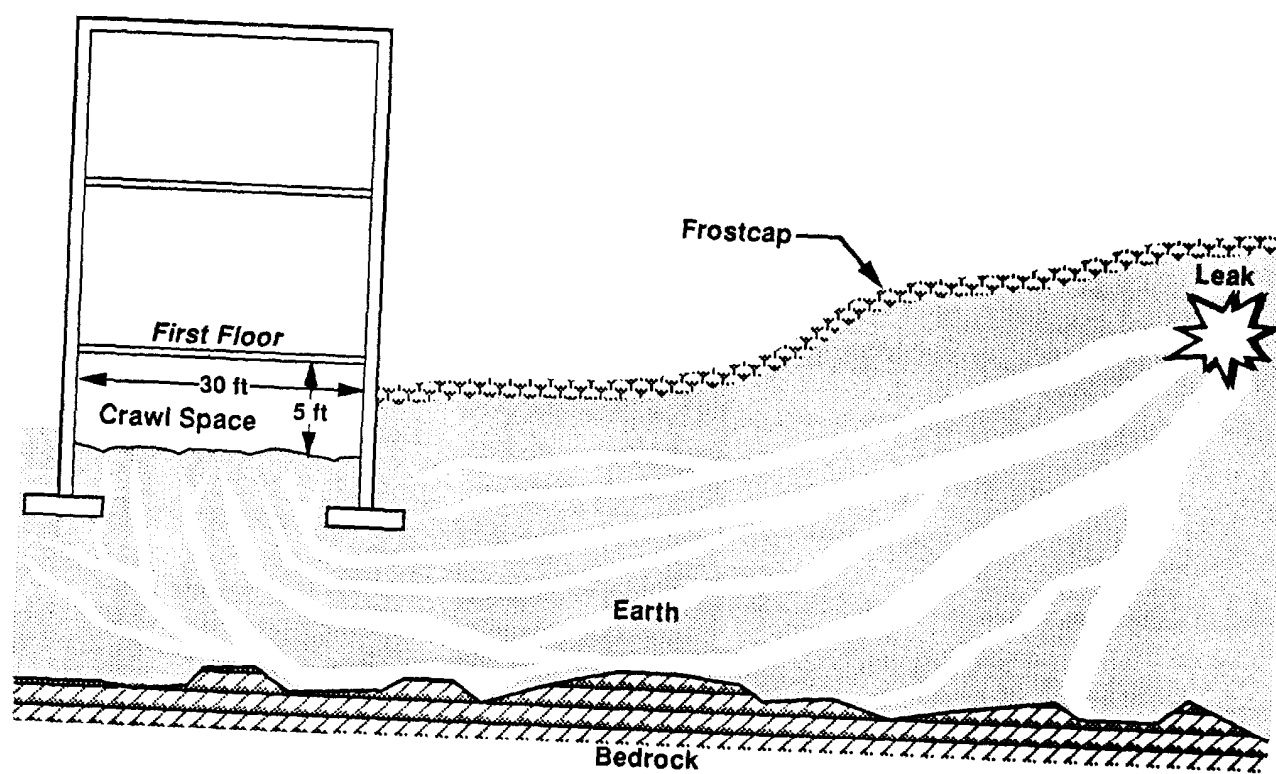
Crested Butte, Colorado



NOT TO SCALE

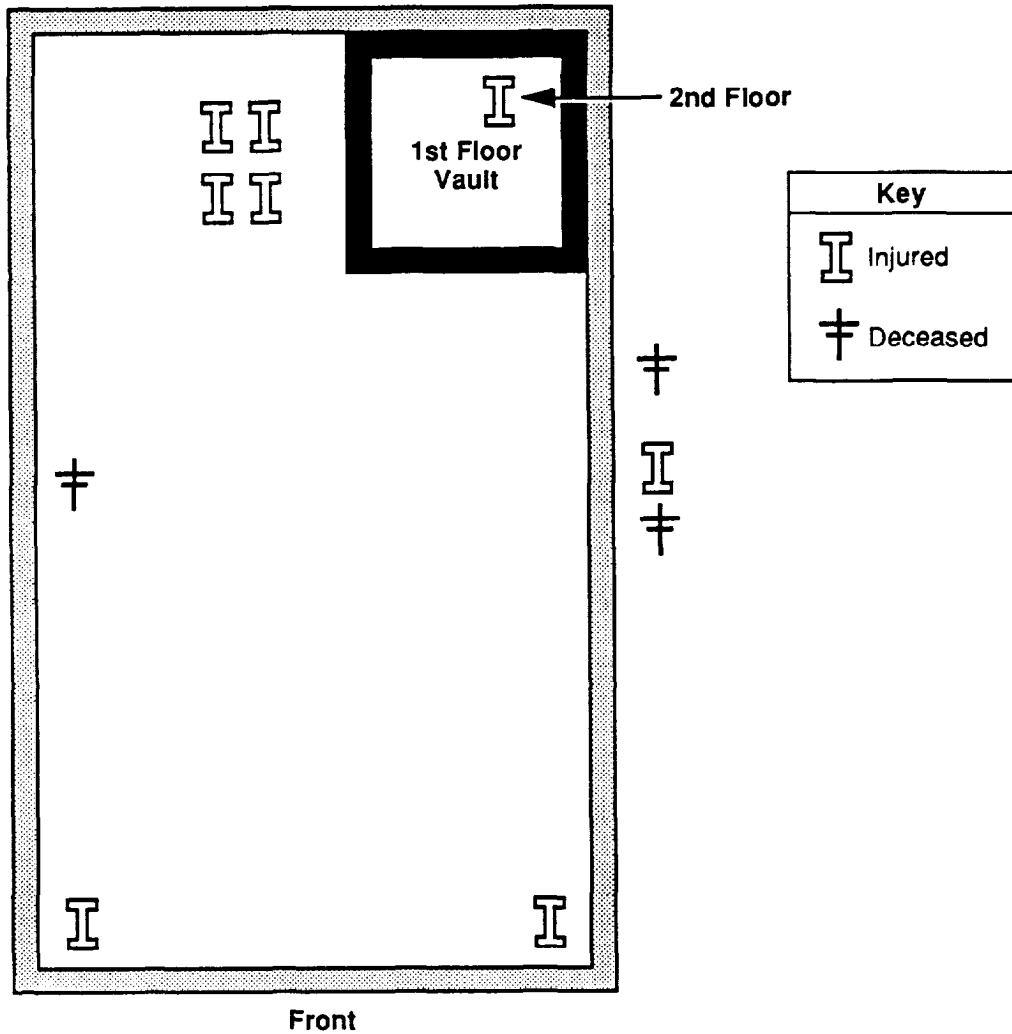
772-5-1-92-1

Spread from Propane Leak to Bank Building



772-5-1-92-2

Crested Butte State Bank Explosion/Collapse Victim Location



Appendix B

<i>Comparison of Natural Gas (Methane) and Propane</i>		
	Methane	Propane
Lower Explosive Limit	4.7	2.15
Upper Explosive Limit	15.0	9.6
Specific Gravity (Air = 1)	. 6	1.52
Ignition Temperature	900-1170°F	920-1120°F